Updates to the EPA Rating for Office Space

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Agenda

- **The EPA Rating**
  - Objectives
  - Characteristics
  - Market Penetration
- **Updating the Rating System**
  - How does the rating system work?
  - Why do we update?
  - What did we analyze?
  - What did we find?
  - What does this mean?
  - How will ratings change?
  - What are the next steps?
- **EPA 2007 Initiatives**
- **Questions for Discussion**

The EPA Rating

EPA Rating Objectives

- Help businesses protect the environment through superior energy efficiency
- Motivate organizations to develop a strategic approach to energy management
- Convey information about energy performance in a simple metric that can be understood by all levels of the organization

EPA Rating Characteristics

- Monitor actual as-billed energy data
- Create a whole building indicator
  - Capture the interactions of building systems not individual equipment efficiency
  - Track energy use accounting for weather and operational changes over time
- Give a peer group comparison
  - Compare a building's energy performance to its national peer group
  - Track how changes at a building level alter the building's standing relative to its peer group

EPA Rating – Market Penetration

- **Almost 30,000 buildings rated**
  - ◆ Includes over 10,700 office buildings
    - • 2.3 Billion square feet
    - • 1,090 Offices labeled as ENERGY STAR
  - ◆ Other major categories
    - • K-12 Schools – over 10,000 rated
    - • Hotels – over 2,500 rated
    - • Hospitals – over 1,100 rated

Updating the Rating System

How does the rating system work?

- Analyze national survey data
  - Commercial Building Energy Consumption Survey (CBECS)
- Develop regression models to predict energy use for specific space types
- Create scoring lookup table
  - Energy efficiency is defined by the residual difference between actual and predicted energy consumption
  - Ratings are based on the distribution of energy efficiency in commercial buildings
  - One point on the ENERGY STAR scale represents one percentile of buildings
- Buildings that perform in the 75th percentile or better can earn the ENERGY STAR label

Why do we update?

- Current system based on 1999 data
- EIA released its most recent survey in July
  - ◆ Based on 2003 market data
  - ◆ More recent conditions provide greater accuracy for comparison among peers
  - ◆ New survey questions on building operation provide better information on key drivers of energy use
- Opportunity to revisit underlying methodology
  - ◆ Evaluate alternative statistical techniques
  - ◆ Simplify methods for easy replication by users

What did we analyze?

- Regression techniques
- Weather normalization and weather data
- Model formats
- New drivers of energy use

Regression Technique: What did we find?

- Current process
  - Use ordinary least squares regression
- Opportunities for improvements – Alternative econometric techniques
  - Ordinary least squares regression
  - Stochastic frontier analysis
  - Nonparametric data envelopment analysis
- No recommended change
  - Continue to apply ordinary least squares regression
  - Reliable results
  - Easy to understand and replicate

Weather Normalization: What did we find?

- Current process
  - Step 1: Use 30-year average HDD and CDD in regression equations
  - Step 2: Adjust actual energy use to energy use that would have been experienced under 30 year average conditions
  - Step 3: Rating based on the comparison of the energy use in Steps 1 and 2
- Opportunities for improvement
  - Available data was 30-year average HDD, CDD
  - Prefer to have actual experienced HDD, CDD
  - The Step 2 adjustment is a "Black Box" for users
- Recommend change
  - Obtained superior data source with experienced HDD, CDD
  - Step 1: Use experienced HDD, CDD in regression equations
  - Step 2: Rating based on comparison of as-billed energy use with energy use in Step 1
  - New process eliminates a step and references better data

Model Format: What did we find?

- **Current Process**
  - Regression dependent variable: "Ln(Source)" – the natural log of Source Energy
- **Opportunities for improvement**
  - Natural log does not have easy physical interpretation
  - With source energy as the dependent variable, building size is a significant driver
- **Recommended change**
  - Regression dependent variable: "EUI" – Source Energy Intensity
  - EUI models yield equivalent predictions
  - EUI is a more common unit
  - Easier to discuss two buildings in terms of EUI

New Drivers: What did we find?

- Current Process
  - Regression depends on: Floor Area, Computers, Workers, Operating Hours, HDD, CDD
- Opportunities for improvement
  - New variables in 2003 survey
  - Explored: Refrigeration, Skylights, Food Preparation, Computer Training Rooms, and Percents Heated and Cooled
- Recommended change
  - Include: Residential and Commercial Refrigeration, and Percent Heated and Cooled
  - They are key operating characteristics
    - Impact energy use
    - Require normalization

What does this mean?

- Revised models will be based on more current data
- Statistical format will remain equally robust
- Weather normalization will access improved data and be easier to replicate
- EUI format will be easier to understand for all levels of an organization
- New variables (refrigeration, % heated, % cooled) will allow for superior comparisons among buildings
  - PM will enter default values for these new variables for all existing buildings
  - Buildings will not be able to receive a label until they have entered their actual value

How will ratings change?

- Ratings are likely to change!
- Exact details of changes are still to be determined
  - Need to finalize models
  - Need to incorporate the Financial Centers, Banks, Courts
  - New model to be released 1st quarter 2007
- Model refinements (2003 data, Weather Normalization, change to EUI) should have relatively small impacts
- New drivers may yield larger changes
  - Commercial Refrigeration
  - % Heated and Cooled
- All changes represent improvements to methodology – send a superior signal to your organization
- Changes will be experienced in baseline and current ratings, tool will still capture past improvements

What are the next steps?

- Make final decisions
- Banks, Financial Centers, Courts
  - Spaces traditionally included with "Office"
  - Still analyzing the relationships among these spaces
- Data Centers, Pools, Garages
  - Additional spaces that may impact the rating of an office building
  - Opportunity to improve these spaces
- ***Schedule: Release new office model in 1st quarter 2007***

EPA 2007 Initiatives

- Model updates for existing space types
  - Similar to Office changes
  - Will be introduced in phases
- New model for a Retail Space type
  - Under development for release in Spring 2007
- Leaders Recognition
  - Change base of recognition from point improvement to percent energy reduction
  - Expand Leaders to include a variety of spaces that are not individually eligible to apply for the ENERGY STAR

Questions for discussion

- How would you define the percent heated and cooled?
- What portions of a building may be unconditioned?
- What types of refrigeration are prevalent in your buildings?
  - Residential refrigeration in break rooms?
  - Commercial refrigeration in cafeterias and restaurants?
- Did you realize that soda vending machines are typically refrigerated?
  - Would you know to count these in commercial refrigeration?